Using SolidWorks & CFD to Create The Next Generation Airlocks

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Prescribed by ANSI Std Z39-18

SolidWorks & CFD Benefits

Capabilities

SolidWorks
- Prototype Design
- Assembly Drawings
- Parametric Models

CFdesign
- Smoke Ventilation
- Natural Ventilation
- Heating & Cooling Requirements
- Contaminant Dispersion
- Radiation (includes solar)
- Identify “Dead Air” Zones
- Airflow Patterns

Output

- **Virtual Prototypes**
- **Photo Realistic Rendering**
- **Animations**

- **CFD Analysis**
  - **Cut Planes**
  - **Iso-Surfaces**
  - **Transient Analysis**
  - **Steady State Analysis**
  - **Particle Trace**

Airlock Effort Abstract

Objectives

- Reduce purge rates
- Increase safety & ease of use
- Incorporate programmable logic into airlock doors (fixed site)
- Decrease set up time
- Decrease components, cost & complexity

Methodology

- Evaluate current design(s)
- Prototype Modeling
- Evaluate SolidWorks models in CFdesign
  - Compare prototype results to current designs

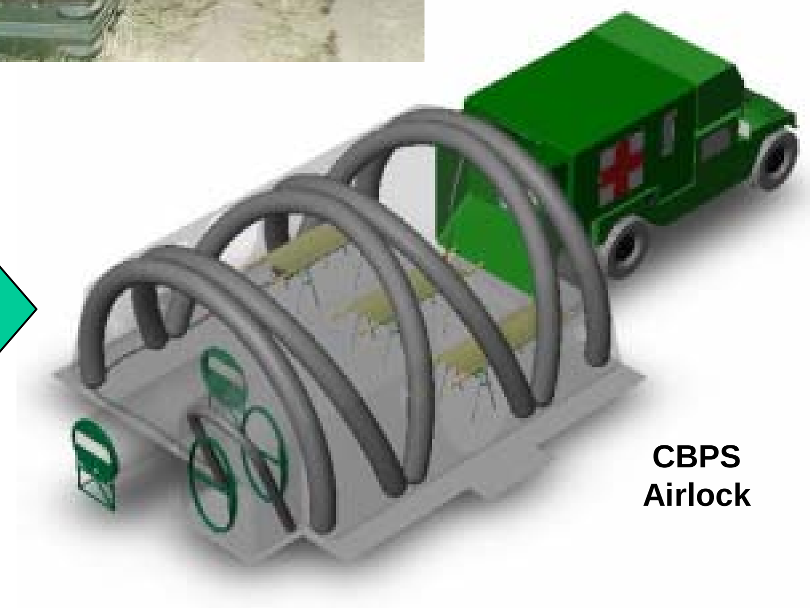
View Results

- Mobile Platform
  - Redesigned PE
- Fixed Site Shelter System
  - Milvan Airlock

Mobile Platform Airlock Background

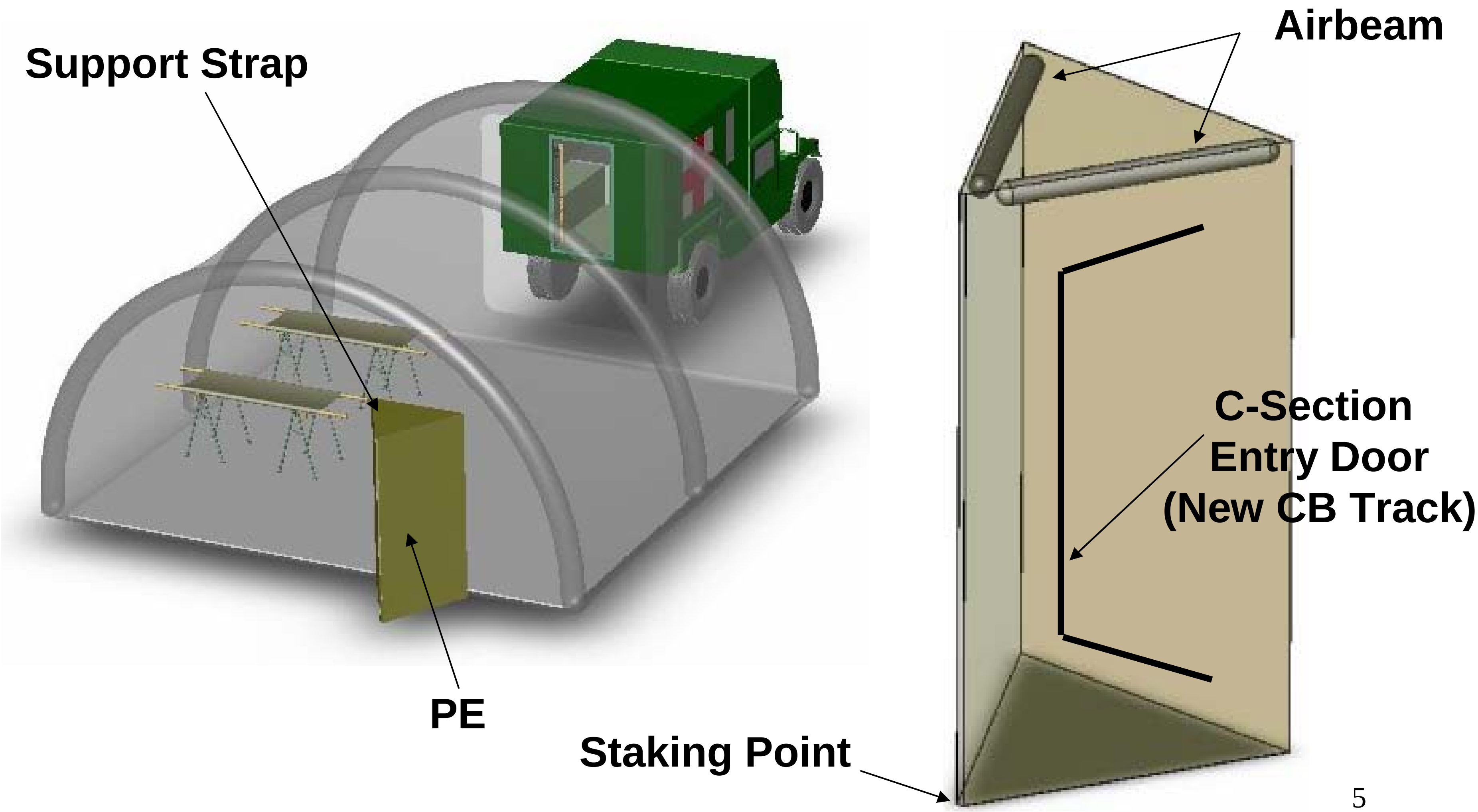
- **Goal**
  - Propose & evaluate design iterations
  - Reduce recirculation cells within the airlock
  - Propose a design with the least logistical burden to the current program
- **Methodology**
  - Model the current PE using FloVent
  - Model PE design iteration(s) using FloVent
  - Compare the velocity profiles, over pressure, efficiencies of the above designs, etc
- **Things to Consider**
  - Design interface with multiple CP shelters
  - Utilize available hardware/geometry
  - Create a self-establishing airlock

CP DEPMEDS Protective Entranceway (PE)



CBPS Airlock

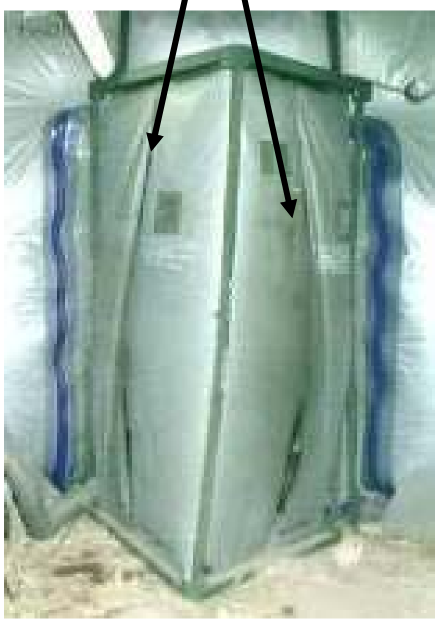
Mobile Platform Airlock Redesign

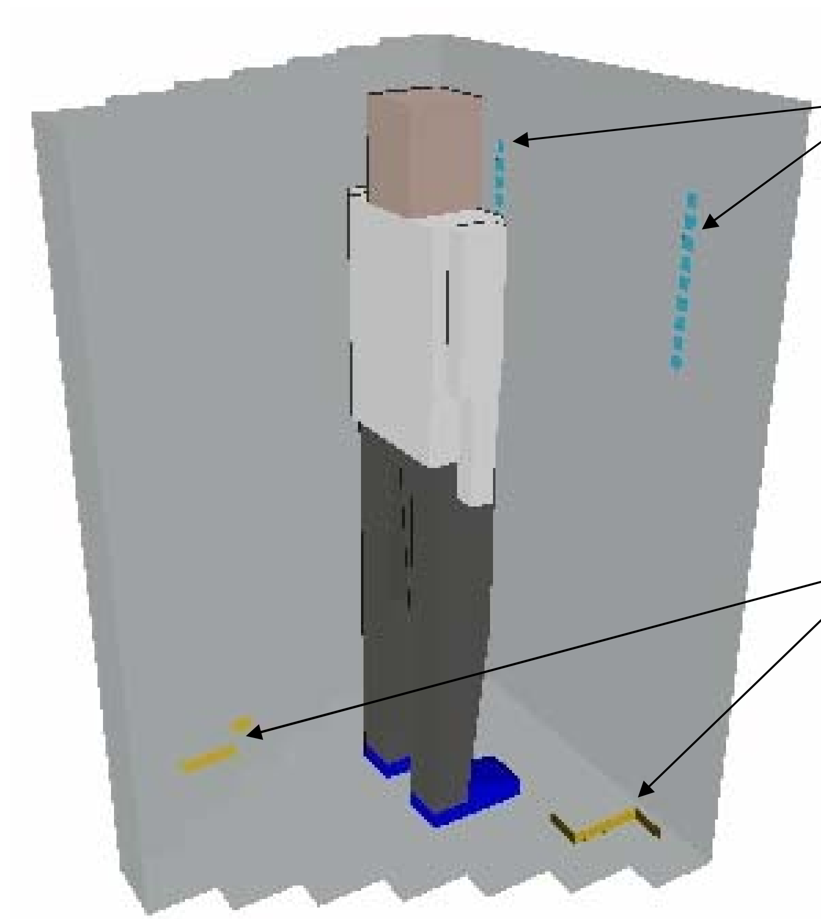


Mobile Airlock Redesign Background

Current PE Geometry

Entry





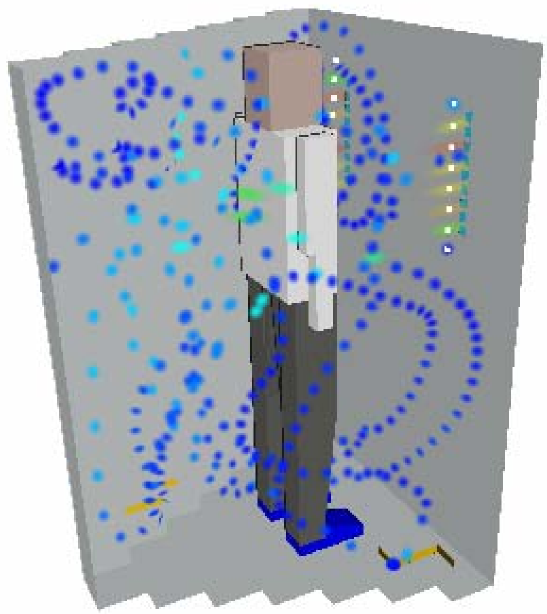
Supply:

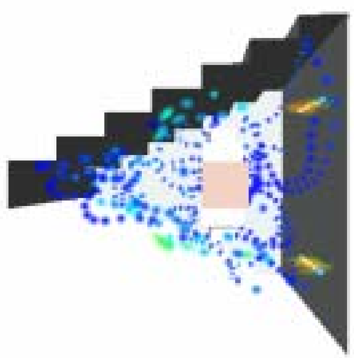
2 columns of 9 holes

14.3 CFM each = 257.4 CFM

Exit Holes: Open to atm.

Mobile Airlock Redesign Background





Current PE Airflow

-18 Supply Holes @ 14.3 CFM each

- 18 Exit Holes on the bottom of each side of the PE

- Entry velocity: 33 ft/s

- Exit velocity: 10 ft/s

- Pressurization: 0.5 IWG

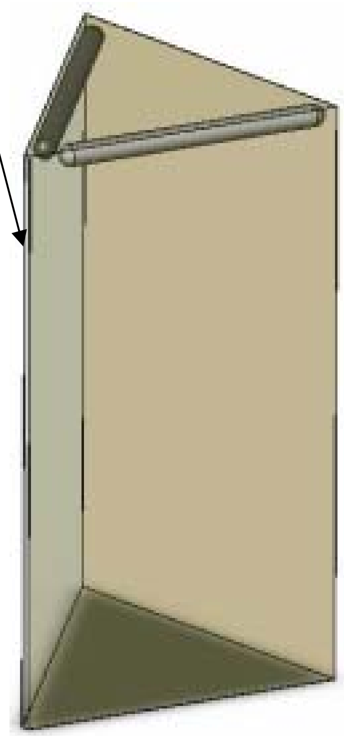
- Air enters as concentrated small velocity jets which result in turbulent flow upon hitting objects (sidewalls & soldier body)

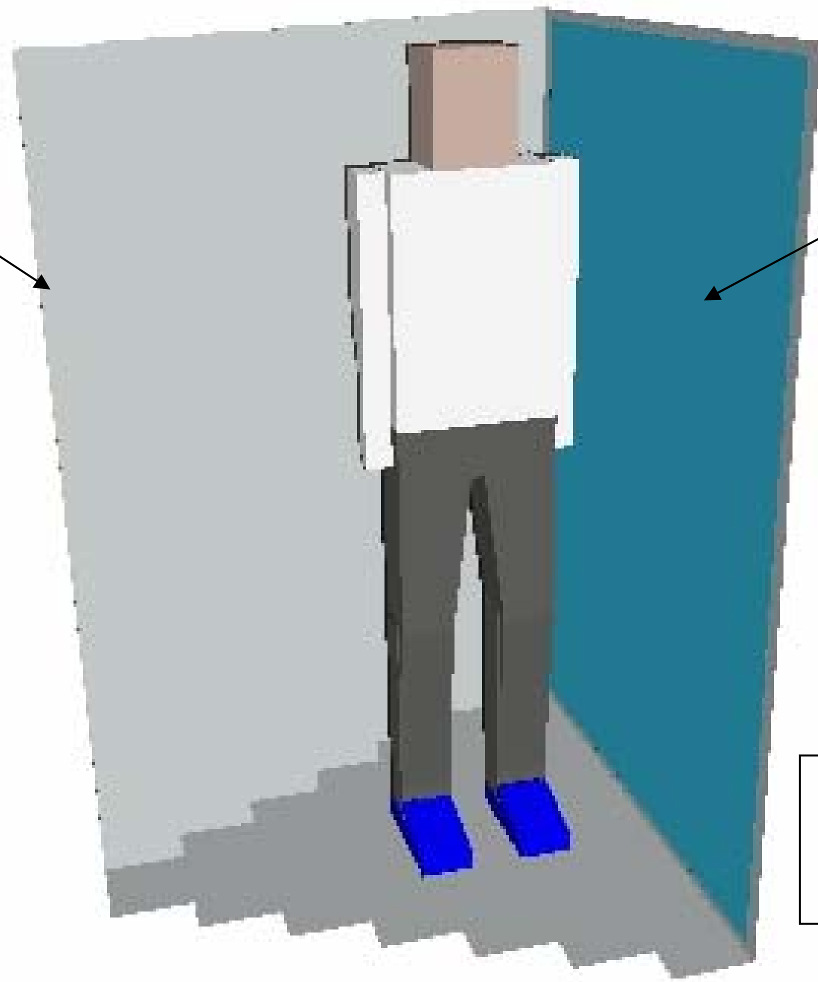
- Airflow is also forced by design to travel along all the x, y & z axis's. This in effect transmits vapor hazards to many areas of the body that potentially weren't contaminated.

Mobile Airlock Redesign

Exit Holes:

Extend along the front vertex open to 0.0psi



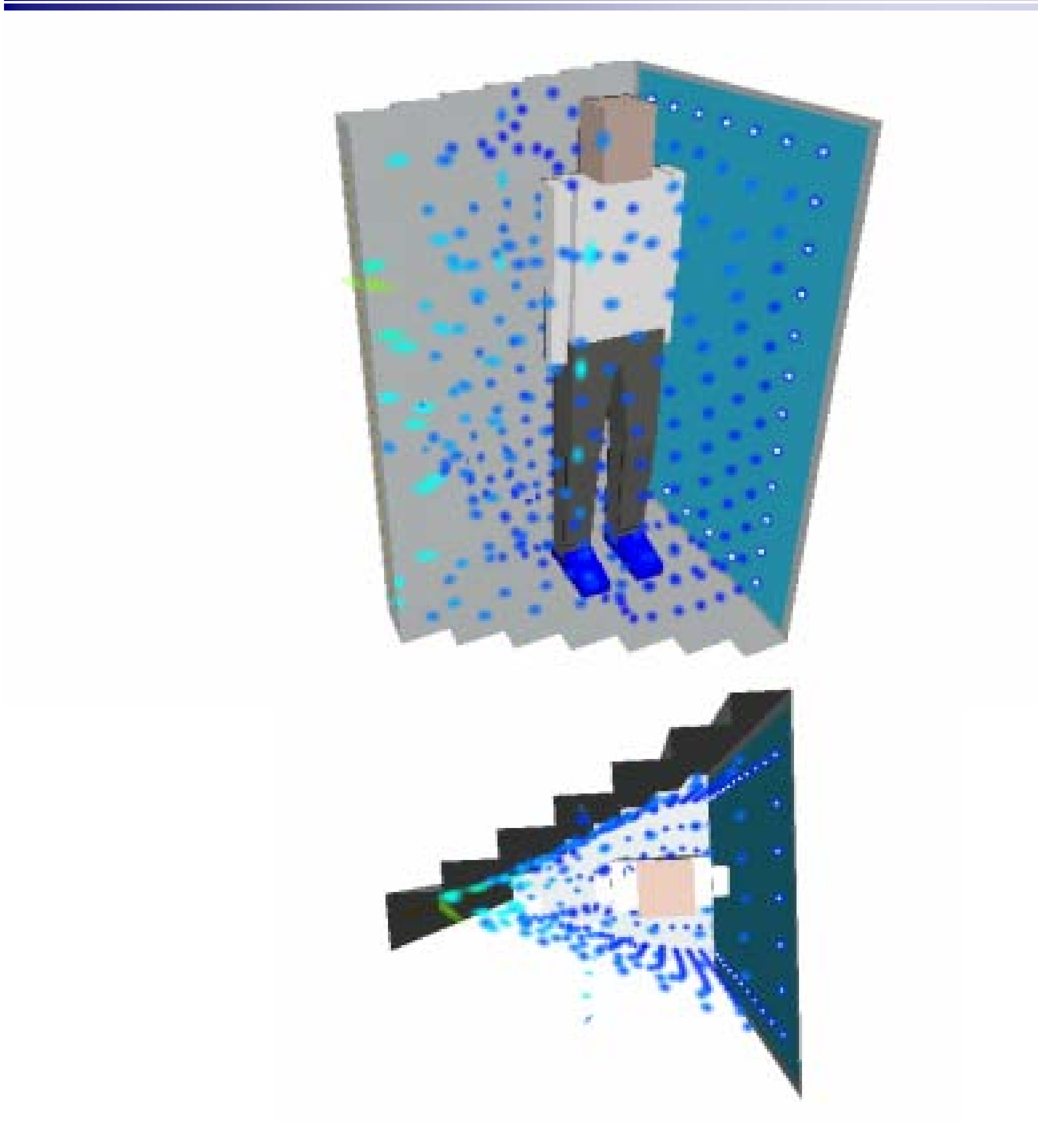


Supply:

257.4 CFM spread over the entrance wall

NOTE: Soldier position within the PE is rotated 90 deg

Mobile Airlock Redesign



PE Mod-1

- Supply of 257.4 CFM over the front wall

- Exit holes down the front vertex of the PE

- Entry velocity: 0.3 ft/s

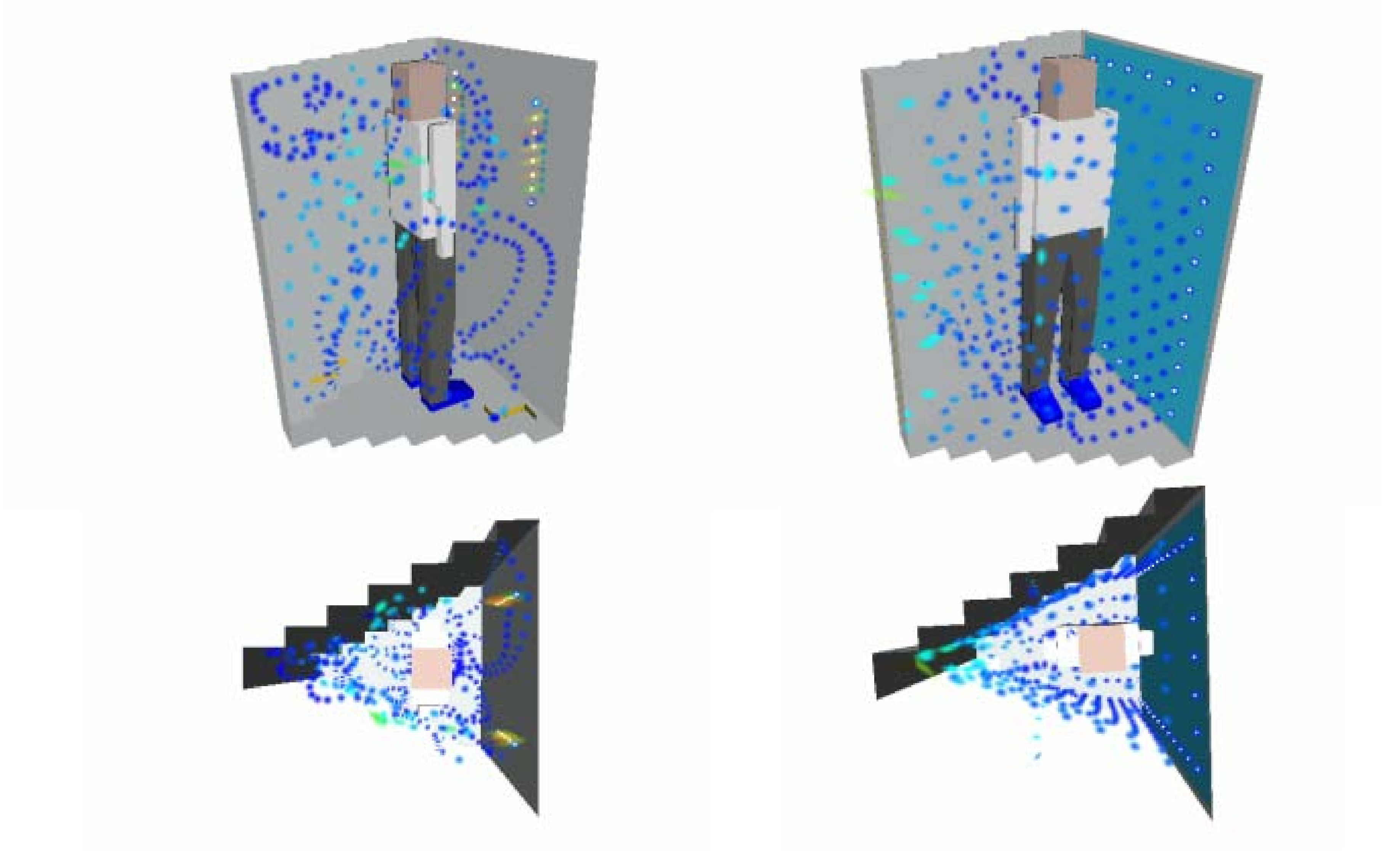
- Exit velocity: 5 ft/s

- Pressurization: 0.25 in H_2O

- Soldier body is rotated to reduce the airflow impedance in the airlock

- The geometry of the Mod-1 PE by design forces the airflow to increase in velocity as it approaches the exits holes. This aids in a unidirectional flow (laminar), and reduction in turbulence

Mobile Airlock Redesign Comparison

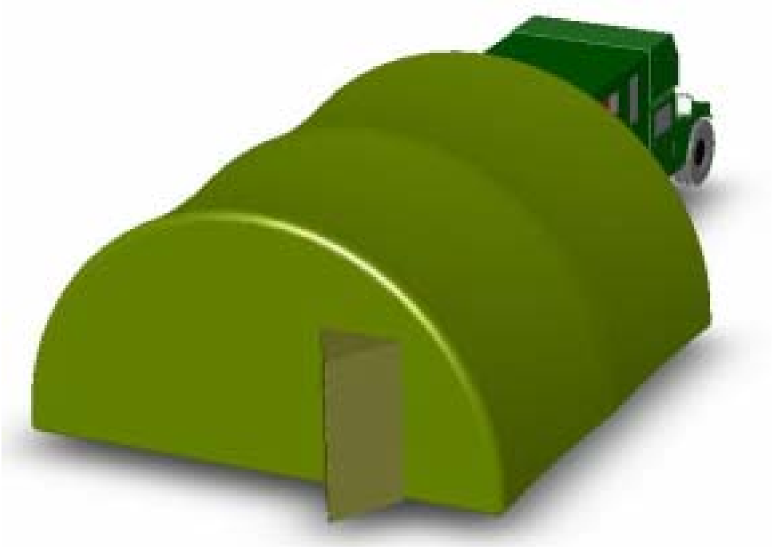


Mobile Airlock Redesign Overview

Airlock Summary

PE (current)

- The airflow distribution in the current PE is non-uniform with many zones of recirculation



PE (Redesign)

-The airflow distribution is more laminar, with reduced zones of recirculation

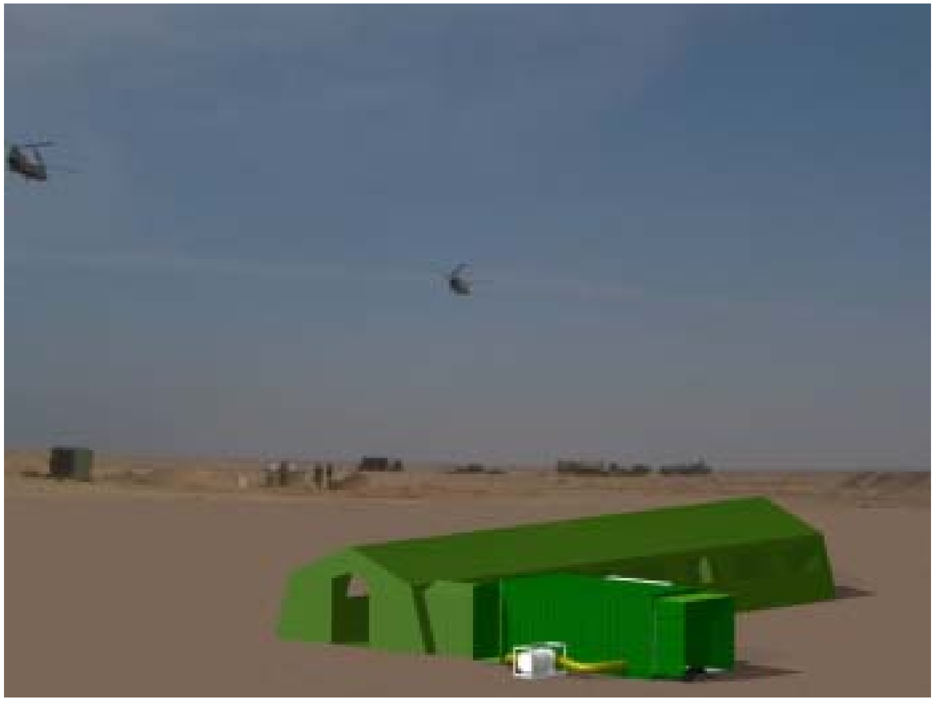
- This design would use a mesh screen in which the air would enter the airlock

- Airlock is self-establishing

- No costly hard doors!

Fixed-Site Airlock Overview

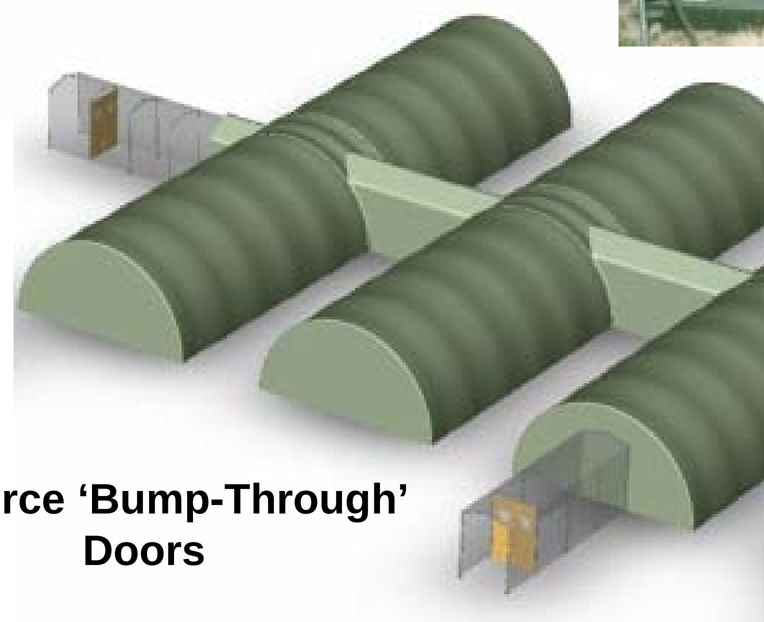
- **Goal**
  - – Propose & evaluate design iteration(s)
  - – Reduce recirculation cells within the airlock
  - – Propose a design with the least logistical burden to the current program
- **Methodology**
  - – Study existing entry/exit airlocks
  - – Model the proposed design in CFdesign
- **Things to Consider**
  - – Design interface with multiple CP shelters
  - – Utilize available hardware/geometry
  - – Integrate '*Lessons Learned*" from **OIF**
  - – Incorporate Ballistic Protection
  - – Design an airlock that can also be used as a standard MILVAN during shipment



Fixed Site Airlock Background

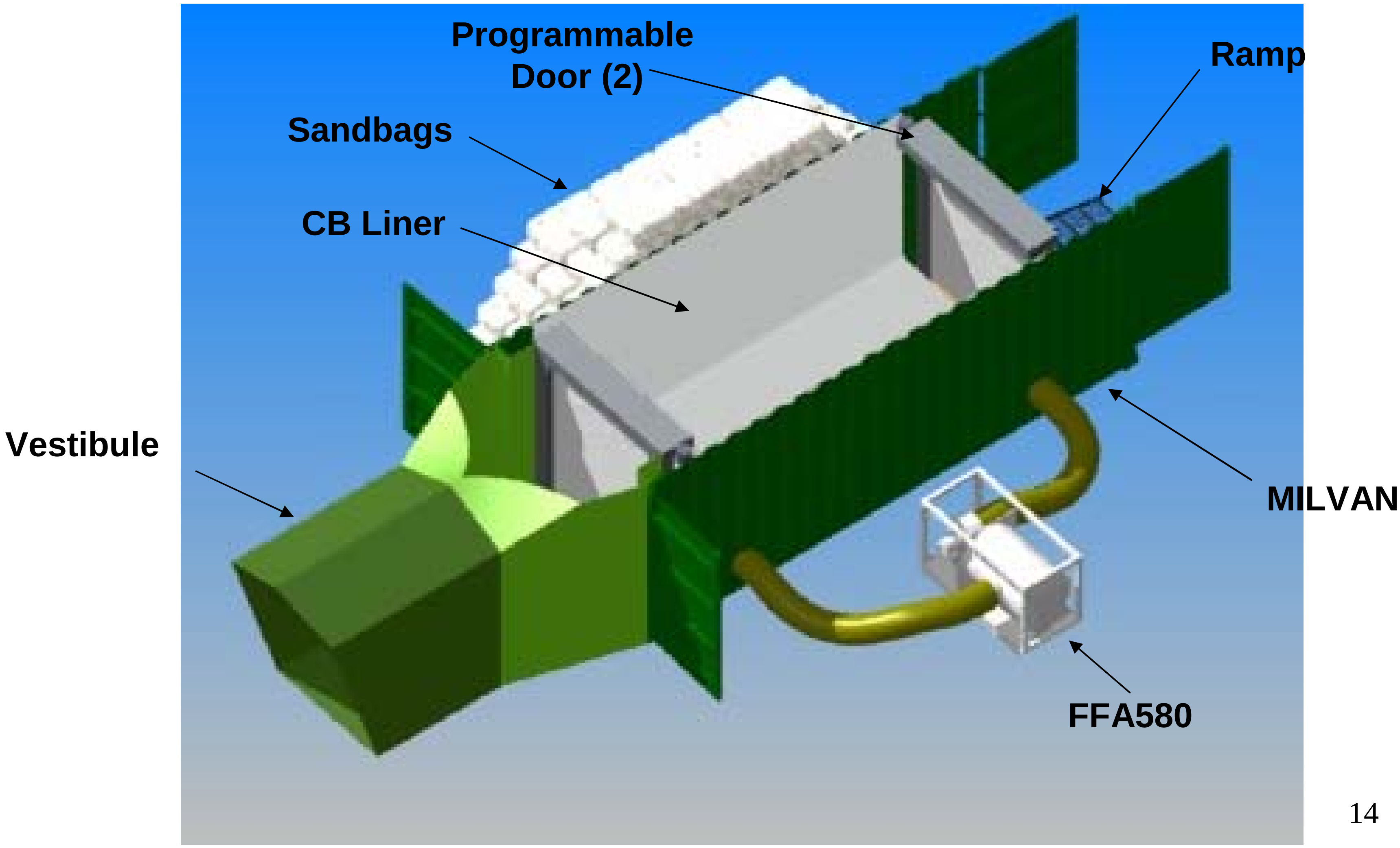
Standard 8x8.5x20 MILVAN

CP DEPMEDS PE & TALP



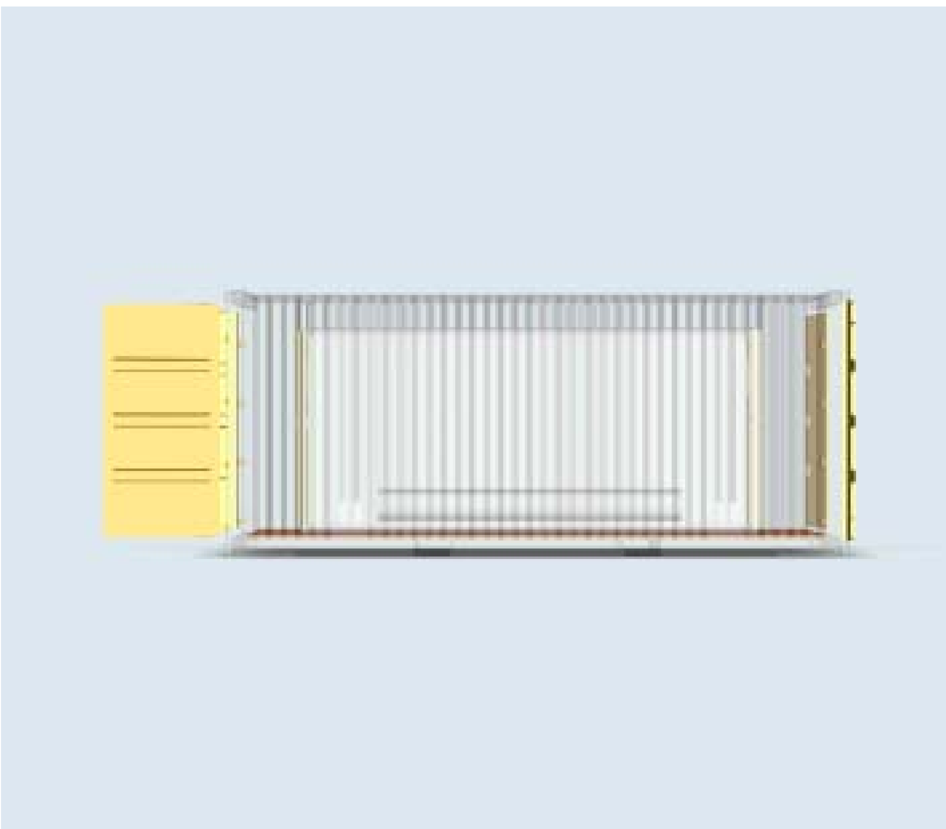
Air Force 'Bump-Through' Doors

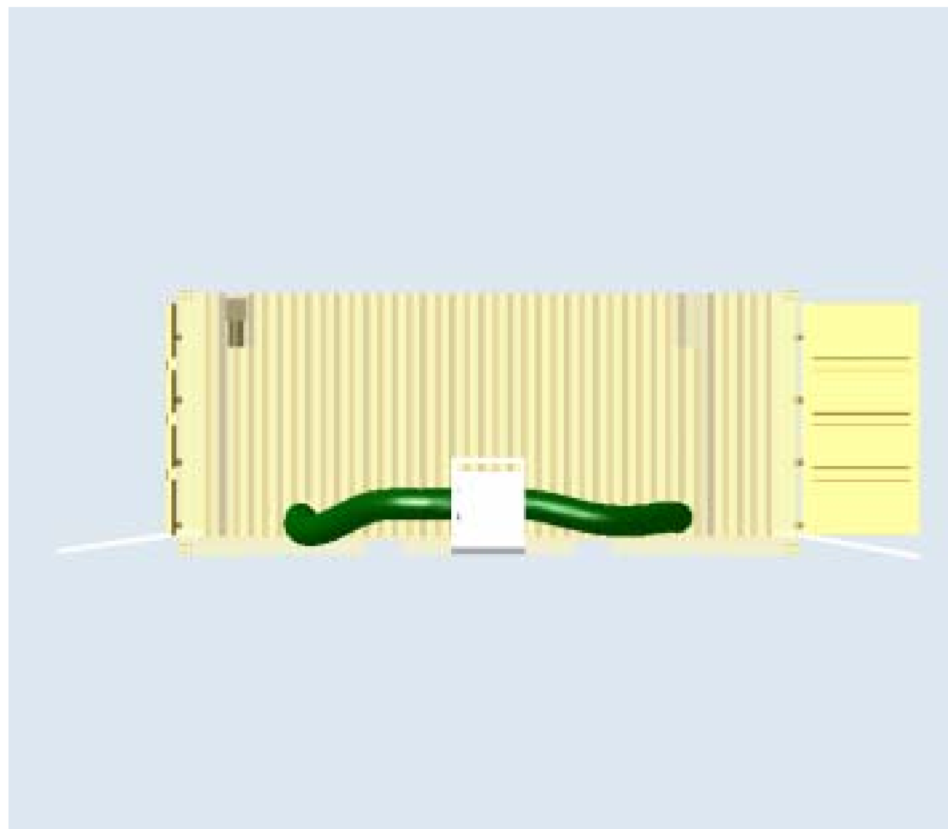
MILVAN Airlock Concept



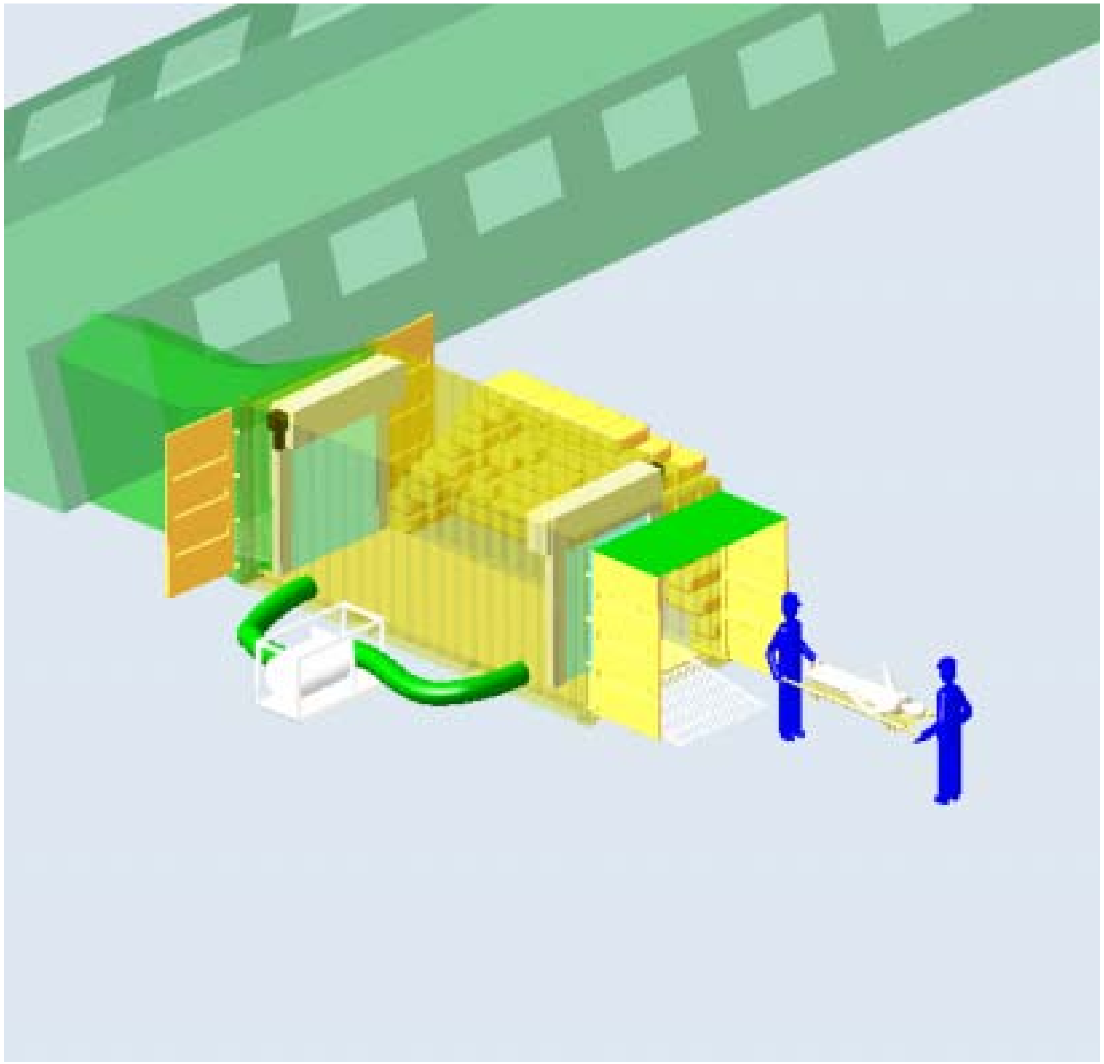
MILVAN Airlock
High & Low-End Applications

Conventional "Bump-Through"	Programmable Automated Doors (Swing or Rise)





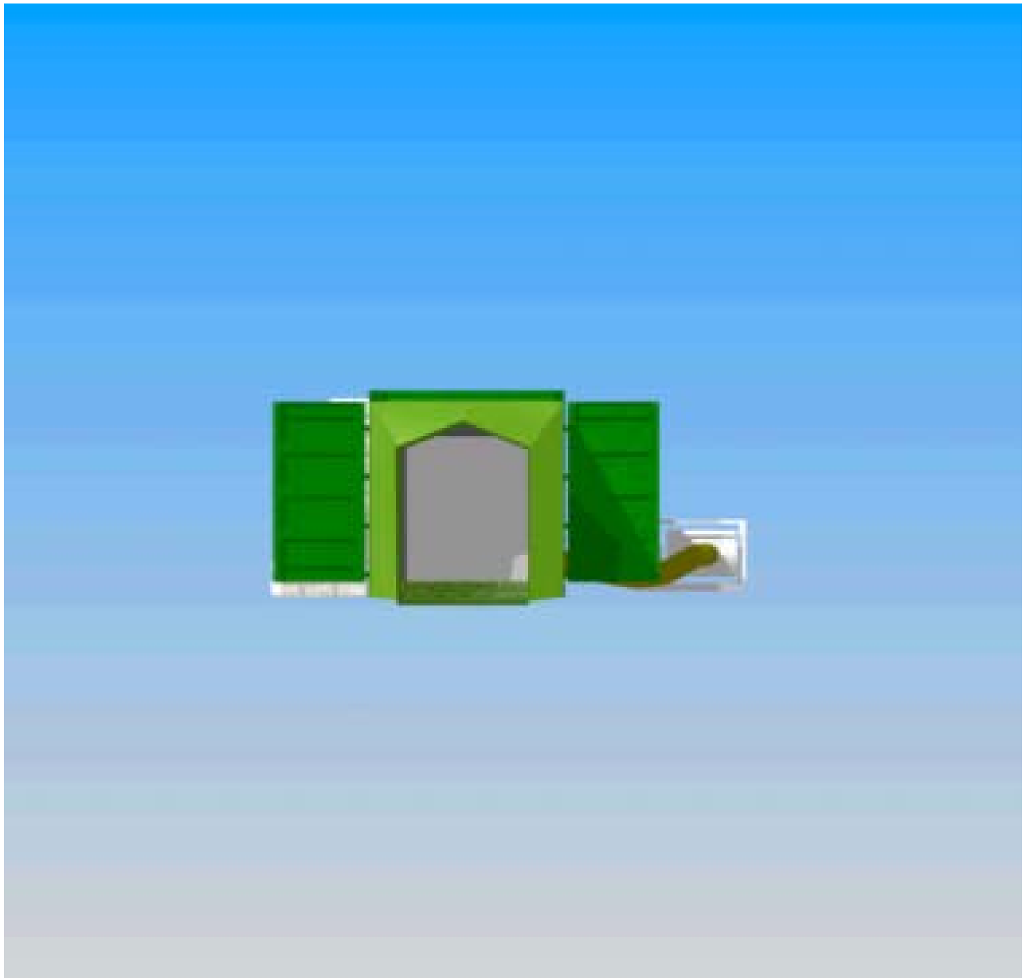
MILVAN Airlock Entry Procedures



<u>Used For:</u>

- Litter Patient
- Standing Patients/Personnel
- Supplies
- Ballistic Protection

MILVAN Airlock Benefits



COMMENTS

- Can be used as a ballistic shelter during air raids
- Shipped in standard 8.5' Milvan
- All additional components and system supplies are shipped within the Milvan
- Airlock large enough to serve many ambulatory patients, and/or multiple litter patients
- Able to be used as a supply airlock as well
- Utilizes existing hardware and 'off the shelf' items
- Compatible with many shelter systems

Conclusions…

Ready to help YOU in your Solid Modeling & CFD Needs

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